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GEOMETRY.

Conducted by B. F. FINKEL, Springfield, Mo. All contributions to this department should be sent to him.

SOLUTIONS OF PROBLEMS.

60. Proposed by WILLIAM HOOVER, A. M., Ph. D., Professor of Mathematics and Astronomy, Ohio University, Athens, Ohio.

Prove that the loci of the foci of variable ellipses passing through the foci of a given ellipse and having the tangents at the ends of the major axes for directrices form a pair of circles passing through the extremities of the major axis of the fixed ellipse and having for diameters the semi-latas rectum of the fixed ellipse.

Solution by the PROPOSER.

If the given ellipse is $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ ....(1),

the equation to the required ellipse is of the form $\frac{x^2}{a_1{}^2}+\frac{(y-n)^2}{b_1{}^2}=1$ ....(2).

This passing through $(ae, 0)$, we have $\frac{a^2e^2}{a_1{}^2}+\frac{n^2}{b_1{}^2}=1$ ....(3).

The directrix of (2) is $x=\frac{a_1}{e_1}$..(4), e_1 being the eccentricity of (2), and $x=a$..(5) is the tangent to the given ellipse at the extremity of its major axis. Then

$\frac{a_1}{e_1}=a$............(6), or $a_1=ae_1$............(7), $a_1e_1=ae_1{}^2$...........(8).

Let (x', y') be the coordinates of the right hand focus of (2) in any one of its positions; then $a_1e_1=x'$............(9), $n=y'$..... ......(10), and by (8) and (9), $e_1{}^2=\frac{x'}{a}$, $1-e_1{}^2=\frac{a-x'}{a}$ ....(11).

Also by (7), $a_1{}^2=a^2e_1{}^2=ax'$. ....(12);

$\therefore$ $b_1{}^2=a_1{}^2(1-e_1{}^2)=x'(a-x')$.......................(13), and (3) becomes

$\frac{a^2e^2}{ax'}+\frac{y'^2}{x'(a-x')}=1$ ....(14).

Reducing, $x'^2+y'^2-a(1+e^2)x'=-a^2e^2$............(15), a circle whose center is on the axis of x, passing through $(a, 0)$, and having diameter $\frac{b^2}{a}$.

Also solved by *G. B. M. ZERR.*